

TAD08 – HL Analytical Practice MS

1. (a) (H—O—H) bond angle changes/bending;
(H—O) bond length changes/stretching; 3
Allow [1] for bonds vibrate if neither of the above points are scored.
polarity (of bond or molecule) changes;
- (b) B has O—H group/is an alcohol;
C has C=O is a carbonyl compound/aldehyde or ketone 2
- (c) 124 (ECF);
bromine has isotopes;
exists as ^{79}Br and ^{81}Br /peaks at M and $M+2$; 3
- (d) $\text{CH}_3\text{CH}_2\text{CHO}$;
 CH_3COCH_3 ; 2
- (e) C is CH_3COCH
no 14 or 29 means no CH_2 or C_2H_5 /15 and 28 indicates CH_3 and CO; 2
- (f) CH_3COCH would have one line; 2
 $\text{CH}_3\text{CH}_2\text{CHO}$ would have three lines/accept splitting pattern;
2. (a) (stationary phase) – water in the fibres of the paper (*do not accept just paper as the stationary phase*);
(mobile phase) – the solvent;
(partition) – distribution between the two phases;
(solvent front) – how far the solvent moves up the paper;
(R_f value) – the distance travelled by one component divided by the distance travelled by the solvent;
Above five points essential.
dyes spotted near bottom of paper;
bottom of paper placed in solvent;
solvent front below base line at beginning;
use of container with lid;
left until solvent near top of paper; 8
Any three of these, [1] each.
- (b) (i) (R_f value) $\frac{0.8 (\pm 0.1)}{4.9 (\pm 0.1)}$;
= 0.16 (*accept answer in range 0.14 – 0.20*);
Allow [1] for $\frac{1.8}{5.9} = 0.3$ 2
- (ii) mixture as more than one spot; 1
3. (a) A is the ultraviolet/UV;
electronic transitions;
B is the infrared/IR;
molecular vibrations;
A is higher energy than B/OWTTE; 5
If A and B the wrong way round [3 max].
- (b) (i) A (because) electron transitions occur; 1
(ii) B from vibration frequencies; 1
Allow ECF from (a).
4. (a) (i) the number of different hydrogen/proton environments/OWTTE; 1
(ii) the environment of proton/neighbouring group/OWTTE; 1
(iii) the ratio of the numbers of protons in each environment; 1
(iv) the number of (identical) protons on the neighbouring carbon atom(s); 1
- (b) 0.9 ppm H on C attached to a second C/alkyl group/ $\text{R}-\text{CH}_3$
2.0 ppm H on C attached to carboxyl C/C of an ester/ $\text{CH}_3-\text{CO}-\text{OR}$
4.1 ppm H on C attached to O of carboxyl group/ester group/
 $\text{R}-\text{CO}-\text{OCH}_2\text{R}$ 3

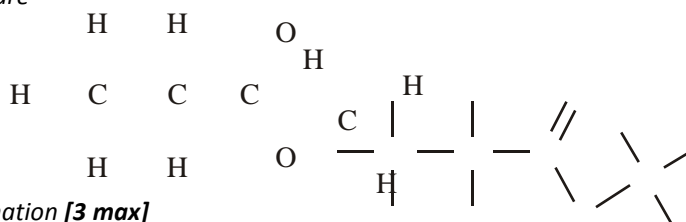
[14]

[11]

[7]

(c) Structure

2

*Explanation [3 max]*two CH₃ groups in different environments;one CH₃ group is not next to a C/has no neighbouring protons;

because it is a singlet (at 4.1ppm);

CH₂ next to CH₃/C₂H₅;

because of triplet and quartet;

5 max

*Award [2] for correct structure, [3] for any three correct points for explanation.**Award [3 max] if structure CH₃COOCH₂CH₃.***[12]**

5. (i) d orbitals/levels split (into two);
electrons on lower energy level absorb radiation from visible spectrum
to move to higher energy level;
leaving complementary colour transmitted/OWTTE;
- (ii) (different ligands have) different electron densities
so causing different amounts of splitting of d orbitals/levels;
so absorbing radiation from different part of the spectrum;

3

2

*Any two for [1] each.***[5]**

6. (i) II and IV;
- (ii) (IV)
it has two double bonds/conjugated double bonds;
less energy needed to excite delocalised electrons/delocalised electrons
absorb energy more easily;

1

2

*Award [0] if wrong compound chosen.***[3]**